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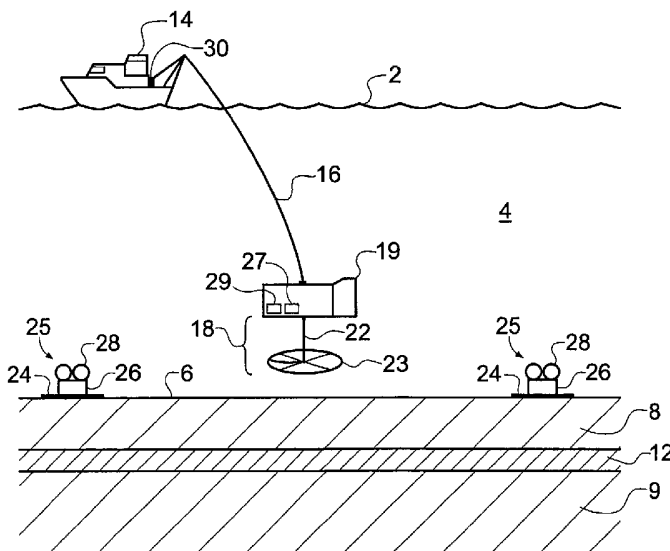
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[Continued on next page]

(54) Title: ELECTROMAGNETIC SURVEYING FOR HYDROCARBON RESERVOIRS



(57) Abstract: An electromagnetic survey method for surveying an area of seafloor (6) that is thought or known to contain a subterranean hydrocarbon reservoir (12), comprising obtaining a first survey data set with a vertical electric dipole (VED) antenna (22) for generating vertical current loops and a second survey data set with a vertical magnetic dipole (VMD) (23) antenna for generating horizontal current loops. In an alternative embodiment, the VMD antenna is dispensed with and the horizontal electromagnetic field is derived from the naturally occurring magnetotelluric (MT) electromagnetic field. In another alternative embodiment, the VED data is compared with a background geological model instead of VMD or MT data.

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— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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INTERNATIONAL SEARCH REPORT

International Application No
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A. CLASSIFICATION OF SUBJECT MATTER IPC 7 G01V3/12 G01V3/15		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) IPC 7 G01V		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, WPI Data, PAJ		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	NEWMAN G.: "A STUDY OF DOWNHOLE ELECTROMAGNETIC SOURCES FOR MAPPING ENHANCED OIL RECOVERY PROCESSES" GEOPHYSICS, SOCIETY OF EXPLORATION GEOPHYSICISTS, vol. 59, no. 4, April 1994 (1994-04), pages 534-545, XP002252013 page 534, column 2, paragraph 2 page 535, column 1, paragraph 3 -column 2, paragraph 3 figures 1-5	1,4,5
Y	--- -/--	2,6, 22-30, 44-52
<input checked="" type="checkbox"/> Further documents are listed in the continuation of box C.		
<input checked="" type="checkbox"/> Patent family members are listed in annex.		
° Special categories of cited documents :		
"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed		
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family		
Date of the actual completion of the international search <p style="text-align: center; font-weight: bold;">19 January 2004</p>	Date of mailing of the international search report <p style="text-align: center; font-weight: bold;">10. 02. 04</p>	
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer <p style="text-align: center; font-weight: bold;">Schneiderbauer, K</p>	

INTERNATIONAL SEARCH REPORT

International Application No

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Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2002/079899 A1 (TABANOU JACQUES R ET AL) 27 June 2002 (2002-06-27) page 6, column 2, paragraph 103 -page 7, column 1, paragraph 105 ---	1,3
Y	CONSTABLE S C ET AL: "MARINE MAGNETOTELLURICS FOR PETROLEUM EXPLORATION PART 1: A SEA- FLOOR EQUIPMENT SYSTEM" GEOPHYSICS, SOCIETY OF EXPLORATION GEOPHYSICISTS. TULSA, US, vol. 63, no. 3, 1 May 1998 (1998-05-01), pages 816-825, XP000775937 ISSN: 0016-8033 cited in the application page 819, column 2, paragraph 2 -page 821, column 1, paragraph 3 figure 4 ---	2,22-30
A	EDWARDS R.N. ET AL.: "First results of the MOSES experiment: sea sediment conductivity and thickness determination, Bute Inlet, British Columbia, by magnetometric offshore electrical sounding" GEOPHYSICS, SOCIETY OF EXPLORATION GEOPHYSICISTS, vol. 50, no. 1, January 1985 (1985-01), pages 153-160, XP002252014 cited in the application page 154, column 2, paragraph 4 -page 157, column 1, paragraph 1 ---	1-5, 22-30
A	WO 02 14906 A (REES DAVID CHRISTOPHER ;PEDERSEN HANS MAGNE (NO); EIDESMO TERJE (N) 21 February 2002 (2002-02-21) cited in the application page 2, line 6 - line 27 figure 9 ---	22-30
Y	WITHERS ET AL.: "A case study of integrated hydrocarbon exploration through basalt" GEOPHYSICS, SOCIETY OF EXPLORATION GEOPHYSICISTS, vol. 59, no. 11, 1 November 1994 (1994-11-01), pages 1666-1679, XP002266840 page 1670 -page 1673; figure 8 ---	6
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International Application No
PCT/GB 03/02379

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>KELLET R ET AL: "THE EFFECTS OF SOURCE POLARIZATION IN CSAMT DATA OVER TWO MASSIVE SULFIDE DEPOSITS IN AUSTRALIA" GEOPHYSICS, SOCIETY OF EXPLORATION GEOPHYSICISTS. TULSA, US, vol. 58, no. 12, 1 December 1993 (1993-12-01), pages 1764-1772, XP000461110 ISSN: 0016-8033 page 1764, column 1, paragraph 1 -page 1765, column 1, paragraph 1 page 1765, column 2, paragraph 2 page 1766, column 2, paragraph 1 figure 1</p>	6
A	<p>URQUHART S A ET AL: "COMBINING CSAMT AND MT IN DIFFICULT EXPLORATION ENVIRONMENTS" THE LEADING EDGE, SOCIETY OF EXPLORATION GEOPHYSICISTS, US, vol. 16, no. 4, 1 April 1997 (1997-04-01), pages 383-384, XP000690152 ISSN: 1070-485X page 383, column 1, paragraph 2 page 384, column 2, paragraph 2 -column 3, paragraph 1</p>	6
A	<p>US 3 548 299 A (DUROUX JEAN ET AL) 15 December 1970 (1970-12-15) column 1, line 43 - line 61 column 4, line 6 - line 12 column 11, line 63 - line 68 claim 6; figure 4</p>	1,6,22
X	<p>US 5 905 657 A (CELNIKER GEORGE WILLIAM) 18 May 1999 (1999-05-18) column 4, line 16 - line 23 column 4, line 37 -column 5, line 3 column 6, line 3 - line 12 column 8, line 33 - line 44 figures 2,3</p>	7-21, 31-43
A	<p>US 4 679 174 A (GELFAND VALERY A) 7 July 1987 (1987-07-07) column 2, line 49 -column 3, line 2 claim 1</p>	7-21, 31-43
Y	<p>WO 98 11455 A (ALTAN MEHMET S ;PGS TENSOR INC (US); ROSS CHRISTOPHER P (US)) 19 March 1998 (1998-03-19) abstract; claim 1</p>	44-52

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB 03/02379

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-5,22-30

Obtaining a first survey data set from a vertical electric dipole (VED) in an electromagnetic survey and additionally:

- obtaining a second set of data from a VMD source

2. Claim : 6

Obtaining a first survey data set from a vertical electric dipole (VED) in an electromagnetic survey and additionally:

- obtaining a second set of data from naturally occurring magnetotelluric electromagnetic fields

3. Claims: 7-21,31-43

Method of planning or analysing an electromagnetic survey, comprising the steps:

- creating a model (normalisation data set)
- setting values for certain parameters (of this model)
- performing a simulation of the electromagnetic survey with VED (VMD or MT)

4. Claims: 44-52

A method of monitoring an area comprising the steps:

- waiting a period of time after obtaining the VED data set
- obtaining a second VED data set
- combining both data sets

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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